

5 a splitter which splits the incoming optical signal into a first  
6 optical carrier and a second optical carrier;  
7 a first AC phase modulator to apply a first electrical signal  
8 carrying a plurality of first channels to modulate the first optical  
9 signal;  
10 a second AC phase modulator to apply a second electrical  
11 signal carrying a plurality of second channels to modulate the  
12 second optical signal, each first channel corresponding to one of the  
13 second channels, and each first channel being phase shifted 90°  
14 relative to each corresponding second channel;  
15 a first DC phase modulator to modulate the first optical  
16 signal;  
17 a second DC phase modulator to modulate the second optical  
18 signal, the first and second DC phase modulators constructed and  
19 arranged to modulate an optical carrier component of the first  
20 optical signal to be phase shifted 90° relative to an optical carrier  
21 component of the second optical signal, the optical carrier  
22 component of the second optical signal having a frequency  
23 substantially equal to the optical carrier component of the first  
24 optical signal;  
25 a directional coupler that coupled to the optical modulator  
26 and combines the modulated first and second optical signals to  
27 form a combined optical signal having an optical carrier component,  
28 such that alternate channels of the combined optical signal are  
29 substantially cancelled; and  
30 wherein the optical modulator creating a plurality of first  
31 single side bands on a side of the optical carrier frequency, a  
32 plurality of first residual images on the opposite side of the optical  
33 carrier frequency, a second side bands on a side of the optical  
34 carrier frequency, and a plurality of second residual images on the  
35 opposite side of the optical carrier frequency.

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1           16. (Amended) The system of claim 15, wherein frequencies  
2 of the plurality of first side bands is offset from the plurality of  
3 second residual images, and frequencies of the plurality of second  
4 side bands is offset from the first residual images.

1           17. (Amended) The system of claim 15, further comprising:  
2 an optical carrier notch filter coupled to the optical modulator.

1           21. (Amended) An interleaved optical single sideband  
2 communications system comprising:  
3 an optical modulator, constructed and arranged to accept an  
4 incoming optical carrier, the optical modulator comprising:  
5 a splitter which splits the incoming optical signal into a first  
6 optical carrier and a second optical carrier;  
7 a first AC phase modulator to apply a first electrical signal  
8 carrying a plurality of first channels to modulate the first optical  
9 signal;  
10 a second AC phase modulator to apply a second electrical  
11 signal carrying a plurality of second channels to modulate the  
12 second optical signal, each first channel corresponding to one of the  
13 second channels, and each first channel being phase shifted 90°  
14 relative to each corresponding second channel;  
15 a first DC phase modulator to modulate the first optical  
16 signal;  
17 a second DC phase modulator to modulate the second optical  
18 signal, the first and second DC phase modulators constructed and  
19 arranged to modulate an optical carrier component of the first  
20 optical signal to be phase shifted 90° relative to an optical carrier  
21 component of the second optical signal, the optical carrier  
22 component of the second optical signal having a frequency  
23 substantially equal to the optical carrier component of the first  
24 optical signal;

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25 a combiner which combines the modulated first and second  
26 optical signals to form a combined optical signal having an optical  
27 carrier component, such that alternate channels of the combined  
28 optical signal are substantially cancelled; and  
29 a notch filter coupled to the optical modulator, the notch  
30 filter including, an optical coupler including at least a first, a  
31 second and a third port, the first port being configured to receive an  
32 output that includes an optical carrier and interleaved optical single  
33 sideband signals, and an optical bandpass filter coupled to a  
34 second port of the optical coupler, the optical bandpass filter  
35 separating the output into a transmitted signal that contains the  
36 optical carrier and a reflected signal that includes the interleaved  
37 optical single sideband signals that are reflected from the optical  
38 bandpass filter to the third port of the optical coupler.

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1 22. (Amended) The system of claim 21, wherein the optical  
2 modulator creates a first single side band on a side of the optical  
3 carrier frequency with a first residual image on the opposite side of  
4 the optical carrier frequency, a second side band on a side of the  
5 optical carrier frequency with a second residual image on the  
6 opposite side of the optical carrier frequency; and a frequency of the  
7 first side band is offset from the residual image and harmonics of  
8 the second sideband, and a frequency of the second side band is  
9 offset from the residual image and harmonics of the first sideband.

1 23. (Amended) An interleaved optical single sideband  
2 communications system comprising:  
3 an optical modulator, constructed and arranged to accept an  
4 incoming optical carrier, the optical modulator comprising:  
5 a splitter which splits the incoming optical signal into a first  
6 optical carrier and a second optical carrier;

7 a first AC phase modulator to apply a first electrical signal  
8 carrying a plurality of first channels to modulate the first optical  
9 signal;  
10 a second AC phase modulator to apply a second electrical  
11 signal carrying a plurality of second channels to modulate the  
12 second optical signal, each first channel corresponding to one of the  
13 second channels, and each first channel being phase shifted 90°  
14 relative to each corresponding second channel;  
15 a first DC phase modulator to modulate the first optical  
16 signal;  
17 a second DC phase modulator to modulate the second optical  
18 signal, the first and second DC phase modulators constructed and  
19 arranged to modulate an optical carrier component of the first  
20 optical signal to be phase shifted 90° relative to an optical carrier  
21 component of the second optical signal, the optical carrier  
22 component of the second optical signal having a frequency  
23 substantially equal to the optical carrier component of the first  
24 optical signal;  
25 a combiner which combines the modulated first and second  
26 optical signals to form a combined optical signal having an optical  
27 carrier component, such that alternate channels of the combined  
28 optical signal are substantially cancelled; and  
29 a notch filter coupled to the optical modulator, the notch  
30 filter including, an optical coupler including at least a first, a  
31 second and a third port, the first port being configured to receive an  
32 output that includes an optical carrier and interleaved optical single  
33 sideband signals, and an optical bandpass filter coupled to a  
34 second port of the optical coupler, the optical bandpass filter  
35 separating the output into a reflected signal that contains the  
36 optical carrier and a transmitted signal that includes the  
37 interleaved optical single sideband signals that are transmitted  
38 through the optical bandpass filter.

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1           24. (Amended) An interleaved optical single sideband  
2 communications system comprising:  
3           an optical modulator, constructed and arranged to accept an  
4 incoming optical carrier, the optical modulator comprising:  
5           a splitter which splits the incoming optical signal into a first  
6 optical carrier and a second optical carrier;  
7           a first AC phase modulator to apply a first electrical signal  
8 carrying a plurality of first channels to modulate the first optical  
9 signal;  
10          a second AC phase modulator to apply a second electrical  
11 signal carrying a plurality of second channels to modulate the  
12 second optical signal, each first channel corresponding to one of the  
13 second channels, and each first channel being phase shifted 90°  
14 relative to each corresponding second channel;  
15          a first DC phase modulator to modulate the first optical  
16 signal;  
17          a second DC phase modulator to modulate the second optical  
18 signal, the first and second DC phase modulators constructed and  
19 arranged to modulate an optical carrier component of the first  
20 optical signal to be phase shifted 90° relative to an optical carrier  
21 component of the second optical signal, the optical carrier  
22 component of the second optical signal having a frequency  
23 substantially equal to the optical carrier component of the first  
24 optical signal;  
25          a combiner which combines the modulated first and second  
26 optical signals to form a combined optical signal having an optical  
27 carrier component, such that alternate channels of the combined  
28 optical signal are substantially cancelled; and  
29          wherein the optical modulator creates a first single side band  
30 on a side of the optical carrier frequency with a first residual image  
31 on a side of the optical carrier frequency, a second side band on a

32 side of the optical carrier frequency with a second residual image on  
33 a side of the optical carrier frequency; and a frequency of the first  
34 side band is offset from the second residual image, and a frequency  
35 of the second side band is offset from the first residual image.

1 25. (Amended) The interleaved optical single sideband  
2 communications system according to claim 24, further comprising:  
3 an input polarization controller, constructed and arranged to  
4 control a polarization of the incoming optical signal;  
5 a polarization maintaining input optical fiber, constructed  
6 and arranged to accept the incoming optical signal from the input  
7 polarization controller and to provide the incoming optical signal to  
8 the modulator.

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1 26. (Amended) The interleaved optical single sideband  
2 communications system according to claim 24, further comprising:  
3 a light emitting device, constructed and arranged to produce  
4 the incoming optical carrier and inject the incoming optical carrier  
5 into the modulator;  
6 a notch filter, disposed after the modulator, the notch filter  
7 filtering a range of wavelengths including a wavelength of the  
8 optical carrier component of the combined optical signal;  
9 a dispersion compensation device, disposed after the notch  
10 filter.

1 27. (Amended) The interleaved optical single sideband  
2 communications system according to claim 26, wherein an amplifier  
3 is disposed after the fiber dispersion compensation device.

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1 29. (Amended) The interleaved optical single sideband  
2 communications system according to claim 26, wherein the  
3 dispersion compensation device is a device selected from the group

4 consisting of: a length of dispersion compensating fiber and a  
5 chirped fiber Bragg grating.

1 30. (Amended) The interleaved optical single sideband  
2 communications system according to claim 24, further comprising  
3 an optical receiver receiving the combined optical signal, the optical  
4 receiver comprising:

5 an optical filter, constructed and arranged to pass a range of  
6 frequencies corresponding to a selected channel of the combined  
7 optical signal; and

8 an optical receiver, receiving the selected channel.

9 31. (Amended) The interleaved optical single sideband  
10 communications system according to claim 30, wherein the optical  
11 filter further comprises a tunable narrowband optical filter, tunable  
12 among a plurality of ranges of frequencies corresponding to  
13 channels carried in the combined optical signal.

14 32. (Amended) The interleaved optical single sideband  
15 communications system according to claim 31, wherein the tunable  
16 narrowband optical filter further comprises a feedback circuit such  
17 that the filter passband can be locked on to a center (or off-center)  
18 of a channel to be passed through the filter.

1 33. (Amended) The interleaved optical single sideband  
2 communications system according to claim 30, wherein the optical  
3 filter further comprises a plurality of fixed narrowband optical  
4 filters, each corresponding to a range of frequencies corresponding  
5 to a single channel carried in the combined optical signal,

6 and the optical receiver further comprises a plurality of  
7 optical receivers each of which is disposed after a corresponding  
8 one of the fixed narrowband optical filters to receive a single  
9 channel therefrom.

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1           34. (Amended) The interleaved optical single sideband  
2 communications system according to claim 24, further comprising:  
3           a wideband optical receiver; and  
4           a plurality of demodulators, each demodulator constructed  
5 and arranged to extract a range of frequencies from the combined  
6 optical signal corresponding to a single channel.

1           35. (Amended) The interleaved optical single sideband  
2 communications system according to claim 24, further comprising:  
3           a plurality of directional couplers disposed in series before  
4 the modulator, the directional couplers combining a plurality of  
5 channels to produce a combined electrical signal from which the  
6 first and second plurality of electrical signals are derived.

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1           41. (Amended) A method of modulating an optical carrier  
2 frequency in an optical modulator that includes a first phase  
3 modulator and a second phase modulator, comprising:  
4           splitting a power of the optical carrier frequency into a first  
5 portion and a second portion;  
6           introducing the first portion of the carrier signal frequency to  
7 the first phase modulator and the second portion of the carrier  
8 signal frequency to the second phase modulator;  
9           applying a first signal to the first phase modulator at a first  
10 phase and to the second phase modulator at a second phase;  
11           creating a first single side band on a side of the optical  
12 carrier frequency, and a first residual image on a side of the optical  
13 carrier frequency;  
14           applying a second signal to the first phase modulator at a  
15 first phase and to the second phase modulator at a second phase  
16           creating a second side band on a side of the optical carrier  
17 frequency, and a second residual image on a side of the optical  
18 carrier frequency; and



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19 wherein a frequency of the first side band is offset from the  
20 second residual image, and a frequency of the second side band is  
21 offset from the first residual image.

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1 50. (Amended) The method of claim 41, wherein the second  
2 side band and the second residual image are on opposite sides of  
3 the carrier signal frequency.

1 52. (Amended) The method of claim 41, wherein the optical  
2 modulator is a single Mach Zehnder interferometer.

1 53. (Amended) A method of transmitting a plurality of  
2 channels, comprising:

3 providing a plurality of electrical signals with adjustable  
4 powers and frequencies, each electrical signal corresponding to a  
5 channel;

6 producing a first and a second split signal corresponding to  
7 each of the plurality of signals, each first split signal being  
8 substantially at quadrature with a corresponding second split  
9 signal;

10 providing an optical carrier signal;

11 multiplexing the optical carrier signal with the split signals to  
12 produce a multiplexed optical signal such that alternate channels  
13 are substantially cancelled and residual images of upper side band  
14 channels do not substantially overlap channels carried on a lower  
15 side band;

16 interleaving the at least one multiplexed optical signal to  
17 reverse positive and negative frequencies of adjacent wavelengths  
18 are reversed.

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1 55. (Amended) A method according to claim 53, wherein the  
2 at least one multiplexed optical signal is further combined with at

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- 3 least one additional multiplexed optical signal by dense wavelength  
4 division multiplexing.

Please add the following new claims:

- 1 56. (New) The method according to claim 55, wherein the  
2 multiplexed wavelengths are interleaved in such a way that the  
3 positive and negative frequencies in the neighboring wavelengths  
4 are reversed .

- 1 57. (New) The system of claim 15, wherein the optical  
2 modulator is a single Mach-Zehnder modulator.

- 1 58. (New) The system of claim 21, wherein the optical  
2 modulator is a single Mach-Zehnder modulator.

- 1 59. (New) The system of claim 23, wherein the optical  
2 modulator is a single Mach-Zehnder modulator.

- 1 60. (New) The system of claim 24, wherein the optical  
2 modulator is a single Mach-Zehnder modulator.

- 1 61. (New) The method of claim 41, wherein the optical  
2 modulator is a single Mach-Zehnder modulator.

- 1 62. (New) The filter of claim 9, wherein frequencies and  
2 power of the sidebands are adjustable.

- 1 63. (New) The filter of claim 15, wherein frequencies and  
2 power of the sidebands are adjustable.